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(54) **Venting device for ink cartridge**

(57) A cartridge for an ink-jet printer is provided with vent passages (70,72) in the cartridge body for venting to the atmosphere a region around the nozzles (37-39) which is sealed when a maintenance cap (60) is moved into contact with a surface of the cartridge surrounding the nozzle plate. The vent passages are formed as grooves in a surface (48) of the cartridge body, the open sides of the grooves being closed by an adhesive preform (32) which attaches a tab circuit (20) to the surface. One end of each passage opens to the atmosphere at a second surface (84) of the cartridge body underneath a portion of the tab circuit which is not adhesively attached to the second surface. A second end of each vent passage extends into a region of the first surface that is not covered by the adhesive preform and tab circuit so that the passages communicate with the sealed region formed when the cap is moved into contact with the cartridge.

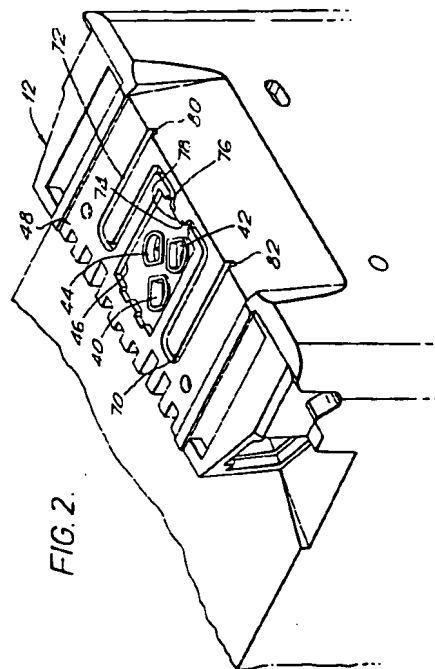


FIG. 2.

EP 0 713 778 A2

tional manner. As the cartridge is moved back and forth transverse to the direction of movement of a sheet of paper, electrical signals are applied from a source (not shown) to terminals 36 and, in accordance with these signals the heater chip 18 heats ink, causing the ink to be ejected from the cartridge through selected nozzles of nozzle groups 37, 38, 39 and the openings 88 and 89. As ink is ejected from a nozzle, a vacuum is created in the exit port associated with the nozzle. This vacuum is communicated through ink passages (not shown) in the cartridge body 12 to a reservoir chamber 22 to suck more ink from the reservoir chamber.

It is conventional as part of a maintenance routine to "cap" the cartridge 10 during periods of non-use to delay or prevent ink in the nozzles from drying. Capping is accomplished by moving a cup-like elastomeric cap into contact with the cartridge 10 so as to form an air seal between the cap and the bottom of the cartridge in a region which encloses the nozzles 37, 38, 39. Fig. 3 shows a conventional cap 60 in a non-capping position, that is, moved away from cartridge 10 so that the cartridge may be moved during printing. As viewed in Fig. 3, the cap 60 has a bottom recess (not visible), and a top recess 62. The recess 62 receives a support (not shown) which moves the cap 60 normal to the bottom surface 48 of the cartridge body 12. Ridges 64 are provided on opposite sides of recess 62 to grip the support.

As indicated by the broken lines in Fig. 3, when the cap 60 is moved into contact with cartridge 10, side walls of cap 60 bounding its bottom recess contact the tab circuit 20 around and outside of the edges of the recess 46 in the bottom of cartridge body 12. The cap 60, tab circuit 20 and nozzle plate 16 thus define an enclosed region around and above the nozzles 37, 38 and 39 as viewed in Fig. 3.

As the cap 60 is moved into capping position, air may become trapped between the cap and cartridge 10 and forced through nozzles 37, 38, 39 into exit ports 40, 42 and 44. The air forms bubbles which, because of their natural buoyancy, will migrate up into the ink feed passages. These air bubbles may block the ink feed passages and cause a loss of prime. Also, if the seal between the cap 60 and cartridge 10 is tight, a vacuum may be created in the sealed region as the cap is moved away from the capping position. This vacuum may suck ink from the nozzles 37, 38, 39 thus depleting the ink supply. Furthermore, the ink sucked from the nozzles finds its way into the region of the printer around the maintenance station where it dries on various operating components.

According to the present embodiment, these problems are solved by providing two vent passages 70, 72 (Fig. 2). The vent passages are preferably formed as open grooves in the surface 48 of the cartridge body 12 at the time the cartridge body is molded. At one end, the grooves connect with recess 46 at set-backs 74 and 76 in the side wall 78 of the recess. At the opposite end,

the grooves terminate at openings 82 and 80 in a sloping surface 84 of the cartridge body. As shown in Fig. 4, the open sides of the grooves are covered by the adhesive preform 32 and tab circuit 20 so as to form the vent passages.

The openings 88 and 89 in tab circuit 20 and adhesive preform 32 are larger than the recess 46 (see Fig. 4) so that there is a region of body surface 48 around side wall 78 of recess 46 and the setbacks 74 and 76 that is not covered. As shown in Fig. 4, the groove 70 extends through this region so that in addition to communicating with recess 46, a short portion 86 of groove 70 is open to the surrounding environment. Although not shown in Fig. 4 a short portion of groove 72 is likewise left uncovered.

The grooves 70 and 72 have a serpentine configuration to make them longer. This prevents air from the surrounding environment from passing through the vent passages into the region sealed between the cap 60 and cartridge 10 when the cap is in capping position.

The portions of grooves 70 and 72 which are not covered by adhesive preform 32 or tab circuit 20 lie within the footprint of cap 60 represented by broken line 90 in Fig. 4. Therefore, when the cap is moved into capping position against the surface of tab circuit 20 the vent passages 70 and 72 are in communication with the sealed region between the cap and the cartridge. If any air is trapped in the sealed region as the cap is moved into capping position, there will be no pressure increase within the sealed region to force air into the nozzles because the trapped air may flow into the vent passages. Conversely, as the cap is moved away from the capping position vacuum in the sealed region will draw air in through the vent passages so that there will be no build-up of vacuum in the sealed region sufficient to suck ink out of the nozzles.

It should be noted that the vent passages 70 and 72 terminate at one end at openings 80 and 82 in the sloping surface 84 which is covered by the tab circuit 20. However, there is no adhesive preform on surface 84 and since the tab circuit 20 is a flexible tape-like element it will not lie completely flat against surface 84 so as to block the openings 80 and 82 of the vent passages. The vent passages may be quite small, on the order of 0.25mm, hence only a small clearance is required between surface 84 and tab circuit 20 in order to fully vent the passages.

From the foregoing description it is seen that the invention provides a simple venting means, carried by the cartridge, for venting the sealed region between the cartridge and a maintenance station cap. Because the venting means is associated with the cartridge, the length, width and depth of the vent paths may be selected for optimum performance depending on the physical properties of the ink in the cartridge. Thus different types of cartridges with different types of inks can be used in printers having maintenance stations where venting is not provided.

vented by said air vent passages (70,72).

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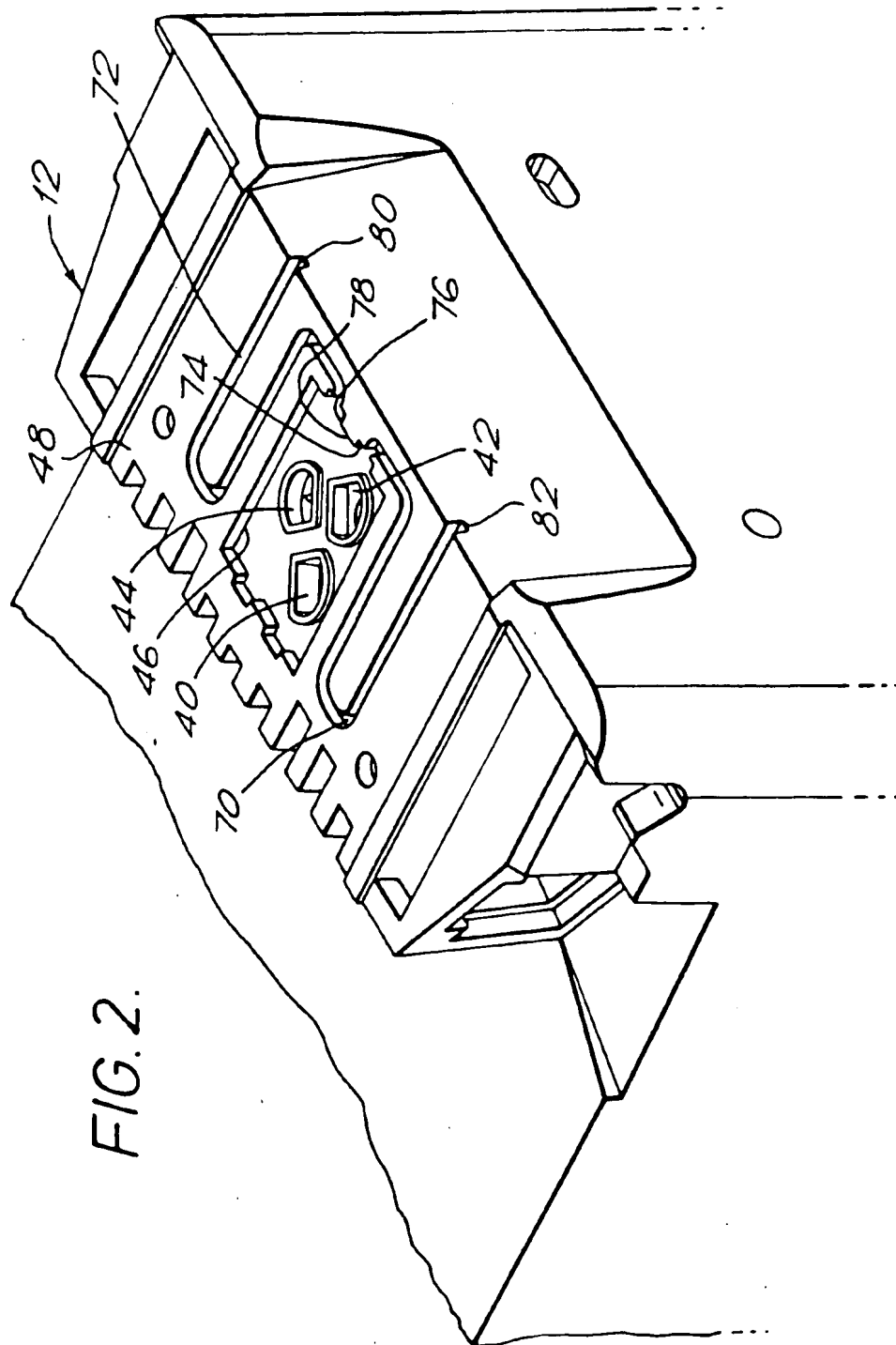
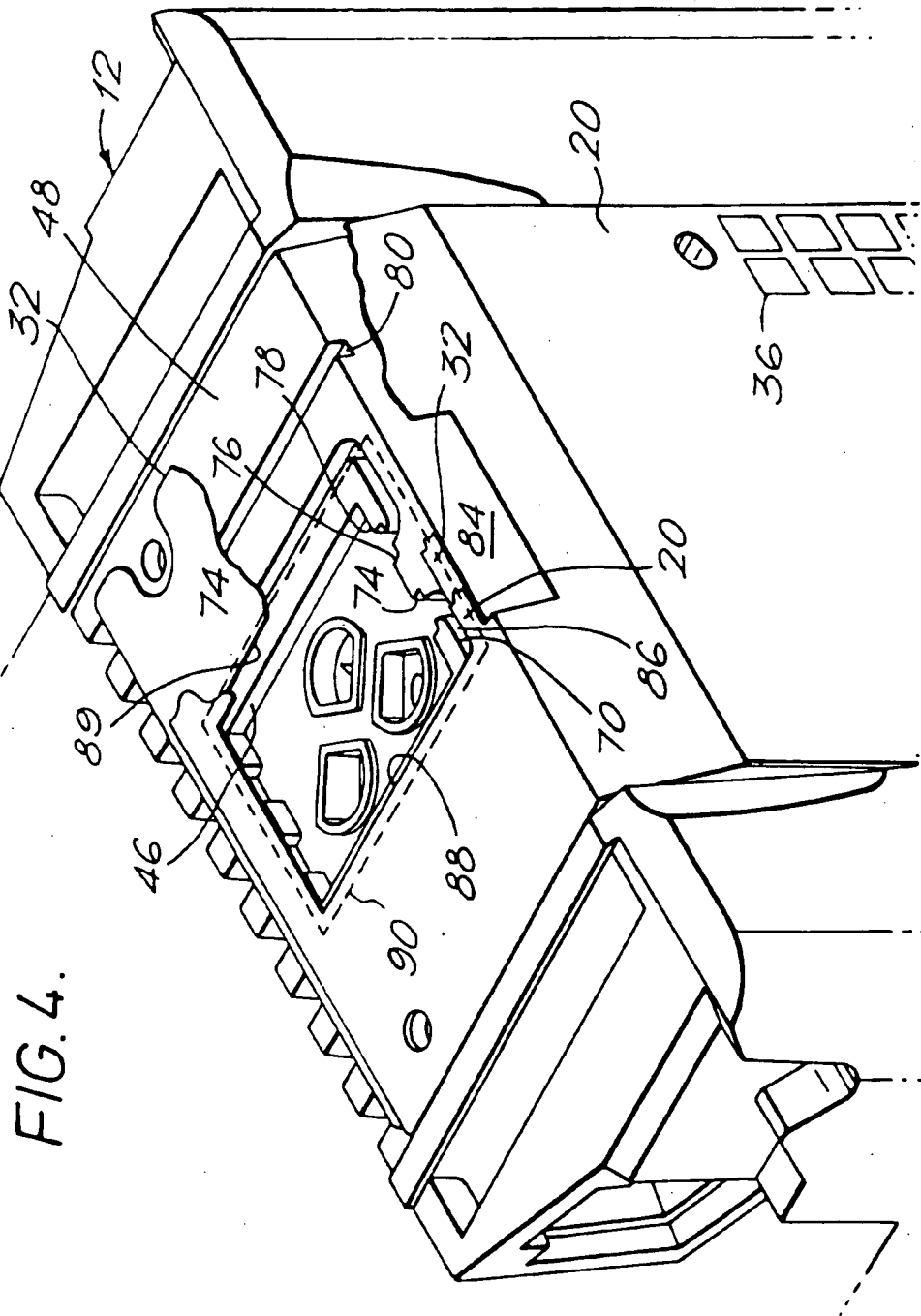


FIG. 2.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 30 6693

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|---|----------------------------------|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (InCL6) |
| X A | US 5 027 134 A (HARMON J P ET AL) * abstract * * column 1, line 60 - column 2, line 10 * * column 1, line 32 - line 39 * * column 3, line 16 - column 4, line 50 * * figures 2,3,5 * | 1 2-17 | B41J2/175 |
| P,X | EP 0 671 273 A (HEWLETT PACKARD CO) * abstract * * column 5, line 31 - line 49 * * figures 1-4 * | 1 | |
| X | US 5 216 449 A (KRIS M. ENGLISH) * column 4, line 51 - column 5, line 13 * * figures 1,3 * | 1 | |
| X | EP 0 526 061 A (HEWLETT PACKARD CO) * abstract * * column 11, line 21 - line 32 * * figures 1,8-11 * | 1 | |
| A | EP 0 418 828 A (CANON KK) * the whole document * | 1,10 | <div>TECHNICAL FIELDS SEARCHED (InCL6)</div> <div>B41J</div> |
| The present search report has been drawn up for all claims | | | |
| Place of search | | Date of completion of the search | Examiner |
| THE HAGUE | | 29 October 1997 | Didenot, B |
| <div>CATEGORY OF CITED DOCUMENTS</div> <div> X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons B: member of the same patent family, corresponding document </div> | | | |

ENCL 1500 03/92 (P4/2/91)